Master's Project Presentation

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My Topic

Applications of Genetic Algorithms on Fully Autonomous Road Networks

- Semi-autonomous vehicles are becoming more prevalent
- Roads are becoming more congested
- Fully autonomous vehicle trials have been legal in parts of the US since 2015[1], with the UK set to follow by next year (2021)[3]
- Much of the current research into autonomous vehicle routing focuses on environments where human drivers are still present
- By removing the human element and working on theoretical *fully autonomous road networks* we can make many useful assumptions about the behaviour of other vehicles
- The solution to road congestion is not to build bigger roads, it is to optimise the traffic flows.
- Just 78.2% of journeys on the UK Highway Agencies roads were *on time* in the year ending June 2014 [5]

Literature Review

I am currently intending to pursue my research assuming the absence of classical speed lanes as described in [4]. This assumption can be made as I will be working on *theoretical fully autonomous road networks*
I have chosen to focus on the applications of Genetic Algorithms on the field for 3 reasons:

1. It is a class of optimisation algorithms that I find particularly interesting
2. GAs are *probabilistically optimal and complete*, i.e given infinite time, they will always produce the global optimal solution if such a solution exists
3. It is a class of algorithm that has seen relatively minimal research in my the specific sub-area

Methods

Language Choice

Not final but preliminary implementations have used Julia[2]

- C-like performance
- Python & Matlab -like syntax
- Matlab like matrices
- Allows for both OO and functional approaches to problems
- Can be compiled
- Allows for use of Unicode in variable & function names so implementations of advanced mathematical expressions are much more readable

```julia
function Σ(xs::Array{Int64})
    ret = 0
    for x in xs
        ret += x
    end
    ret
end

xs = [1,2,3]

Σ(xs) == reduce(+,xs) # true
```

Figure: Example Julia code

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- Slow relative to alternatives
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- Has some static typing ability

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Rust:

- Slower to prototype in as stricter type system to guarantee memory safety
- Memory safe, advantage over C/C++
- Very performant, runs well on embedded systems
- Relatively large binaries due to static dependency linking
- Easier to package & deploy than Julia

References


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